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Department of Education

Arrangement and Timing

of Topics for

Mathematics

Grades IX and X

Issued by Authority of
The Minister of Education

ARRANGEMENT AND TIMING

OF TOPICS FOR

MATHEMATICS

Grades IX and X.

Purpose. At the request of the Department, a committee of experienced teachers has drawn up an arrangement of topics and a selection of exercises from the authorized texts which may be taught in the time that is usually assigned to the courses in Mathematics of Grades IX and X. The aim was to make the outline sufficiently definite to provide guidance to those teachers who are teaching the courses for the first time, to those who are carrying a heavy teaching load which leaves little time for the organization of any one subject, or to those teachers who have not yet found a satisfactory way of presenting the courses. It should be understood that the memorandum is a sample outline and that it is offered as a guide rather than a rule.

Arrangement. The topics of Grades IX and X were treated as constituting one unit of work to be covered in two school years and within this period the topics were arranged to produce a saving of time. Experimental Geometry was postponed until the beginning of the second year so that in Grade IX emphasis might be placed on Arithmetic and Algebra, including simultaneous equations and some additional factoring. However, if Practical Geometry was taught in Grade IX during the year 1945–46, the time which is assigned to Experimental Geometry of Grade X in this outline should be used in the Algebra part for factoring and for simultaneous equations in 1946-47.

Members of the committee were of the opinion that the Grade IX course should begin with Arithmetic in an attempt to obtain accuracy with speed in calculation. The pupil will be able to appraise his progress if he is given an objective test in simple computation during the first week in school and again when the study of the topic is completed. Some teachers may prefer to begin with Algebra and later take the Arithmetic and Mensuration.

The value of short tests is recognized and time for them was allowed in the review periods at the completion of main topics.

Correlation with other subjects. In Science a pupil's proficiency in arithmetical computation is a prerequisite for the study of many topics. In return for greater emphasis upon Arithmetic by the teacher of Mathematics the teacher of Science might be willing to stress the Metric System and its applications. Because Grade IX pupils use and interpret charts and graphs in the Geography course, the committee felt that such practice might be made to serve as an introduction to algebraic graphs in Grade X.

Greater understanding of each other's objectives and difficulties would be reached if the teachers of Mathematics in the Elementary and Secondary Schools would confer regularly. This practice has been followed in several communities.

Timing. Periods were assigned to each topic on the basis of a forty-five period week with five periods per week in Grade IX and six periods in Grade X. Allowance has been made in each Grade for two weeks of review and two weeks of examinations besides the periods assigned to the review of various topics

as their study is completed. A few periods of reserve time have been left for emergency use.

References. All references are to the authorized texts—General Mathematics, Book I and Book II.

The Department would be glad to hear of further experimentation by teachers of Mathematics in an effort to produce a natural integration of the topics required for a basic course in Mathematics.

GRADE IX MATHEMATICS

GRADE IX ARITHMETIC — Total 30 Periods

OBJECTIVES

1. To stress the fact that the fundamental arithmetical operations are a prerequisite to any course in algebra or geometry.
2. To make the pupil aware of the fact that he will use his knowledge of arithmetic throughout his high school work.
3. To develop speed with accuracy in arithmetical operations.

SUGGESTIONS

To assist in attaining this third objective, 10 minutes during each of two periods a week should be set aside for rapid calculation; this should be continued during the entire arithmetic portion of the course, and longer if the teacher deems it necessary or desirable. Should the teacher discover certain weaknesses in some of the arithmetical operations, the division of time might be altered somewhat in order to spend time on remedial work.

PERIODS	TOPICS
1	Sections 1 to 5 briefly; selected problems from pages 6,7,8,9, done orally. Have the class read pages 1 to 7.
4	Section 6. Problems to end of No. 15, page 14.
3	Sections 7, 9, 10; selected problems to end of No. 28, page 25. NOTE—Instead of doing Sec. 9 at one special time, its contents might be shown when problems in adding, subtracting, etc., are being done.
2	Sections 11 and 12. page 29, No. 6, 7, 8, 9; page 30, No. 1 to 8; page 31, No. 12 and 13.
7	Sections 14 to 20. pages 34, 35, to end of No. 44; pages 37, 38, No. 3 and 4; pages 41, 43, 44, 45, all exercises.
3	Review exercise, pages 46, 47, to end of No. 60.
5	Sections 21, 22, 23, 25, 26, 27. Problems on pages 57, 58, 59. These problems are not as good as they might be, so, if the teacher prefers, he might substitute problems from other sources. Selected problems from page 64.
2	Percentage, Sec. 29; problems, pages 66 and 67.
2	Selected problems, pages 71 to 74.
1	Test.

GRADE IX ALGEBRA — Total 125 Periods

OBJECTIVES

1. To show the advantages of algebraic notation in reasoning with abstract concepts.
2. To develop the pupil's skill in analyzing and solving problems.
3. To encourage the development of self-responsibility on the part of the student in regard to his work in mathematics.

SUGGESTIONS

Undue loss of time can be avoided if the teacher refrains from taking complete solutions of problems which have been done successfully by the majority of the students in the class. Individual difficulties could be discussed with the pupils concerned. Speed drills with accuracy should be held regularly Actual assignments are suggested here to help the inexperienced teacher.

PERIODS	TOPICS
	Chapter V (11 periods)
1	Algebraic Notation. Use of a letter number to represent the length of a line (Sec. 43). Oral drill on this to develop such expressions as $a+b$, $x+y+z$, $2a$, $3b$, etc. Values which some of these might take when particular values are given to the letter numbers. Stress the fact that each letter is used to represent a number. To do this—"a" might always be referred to as "the number a."
1	A short review of the notation discussed in previous lesson. Use exercise of problems on page 104. Do these orally because geometric construction is being postponed until Grade X.
1	Use of letter numbers to represent the measures of the length and width of a rectangle and of the side of a square or of a cube. Oral drill on this to develop such expressions as xy, ab, $6mn$, x^2, a^2, m^3, etc. Find values which some of these will take when particular values are assigned to the letter numbers.
1	Further drill on algebraic notation (Sec. 45). Some drill on the difference between $4x$ and x^4; between $2x^3$ and $(2x)^3$, and similar expressions.
3	Problems, pages 109 and 110. NOTE—Sec. 46 and 47 are being done later in Mensuration.
1	More algebraic notation (Sec. 48). Adding and subtracting like terms, as at top of page 117; several other examples should be supplied from other sources as there are only a few examples given in this part of the text. Begin oral part of exercise on page 117.

Periods	Topics
3	Selected problems from Sec. A and B, pages 117 to 121. Those which depend upon a knowledge of geometry should be omitted.
	Chapter VI (11 periods)
	The rule of transposition (Sec. 133) in solving equations should be introduced as early as possible after the fifth lesson in this chapter.
3	Sec. 49 and 50. Exercise, pages 126 and 127. Use some of the last examples here to illustrate the four axioms (page 128) used in solving equations; axioms 1 and 4 in No. 20; axioms 2 and 3 in No. 21.
2	Review axioms (Sec. 53). Teach proper method of verification (Sec. 54). Exercise, page 130, to end of No. 36.
5	Note—In "word problems" which follow, it is suggested that these be grouped in "types" according to the kind of solution required. Sec. 51. Oral exercise, pages 124 and 125. Page 131, No. 37 to 40. Sec. 55, 56, 57. A and B exercises, pages 135 to 137. Selected problems, page 139.
1	Review.
	Chapters IX and X (18 periods)
	In Chapter X the sense of gain and loss should be stressed rather than the memorization and mechanical use of rules of sections 89 and 92.
3	Sections 82, 83, 84, 85. Selected problems from exercises, pages 212 and 216.
5	Addition. Complete to end of No. 23, page 229.
5	Subtraction. In Sec. 94, emphasize subtraction by the additive method, using many positive numbers first, and later with numbers of both qualities, before considering the rule for subtraction. Complete to end of exercise, page 233.
2	Sections 96 and 97. Problems on pages 235 and 236.
3	Exercises, pages 237, 238, and review.

Periods	Topics
	Chapter XI (19 periods)
6	Multiplication, to end of exercise, page 248. Alternative methods might be used for teaching Sec. 100. (1) Write on the board $\begin{array}{rrrrrrr} +3 & +2 & +1 & +0 & -1 & -2 & -3 \\ +4 & +4 & +4 & +4 & +4 & +4 & +4 \\ \hline \end{array}$ Have pupils give the products of the first four of these and then have them try to give a clear explanation of the products which they suggest for the last three. Take some additional examples; from these the first two sign laws may be deduced. Agree that $7\times6=6\times7$, so that $-3\times+4=+4\times-3$, etc. Take additional examples like $+5\times-2$; this gives the third rule of signs. Write on the board $\begin{array}{rrrrrrr} +3 & +2 & +1 & +0 & -1 & -2 & -3 \\ -4 & -4 & -4 & -4 & -4 & -4 & -4 \\ \hline \end{array}$ The last three of these illustrate the fourth rule of signs. (2) Sec. 37, page 50, Ontario High School Algebra, by Crawford.
5	Pages 248 to 253. Extend multiplication to include the product of a trinomial by a binomial, and of a trinomial by a trinomial.
4	Simple Division; complete exercise, page 257.
1	Sec. 111 and exercise, page 258.
3	Review exercise and test.
	Chapter XII (25 periods)
	Care should be taken by discussion with the class to make sure that they understand thoroughly when an expression is in "term" form and when it is in "factor" form. Grade IX types are extended here to include (1) grouping to obtain a common factor, (2) trinomials of type ax^2+bx+c.
4	Common Factor and Simple Grouping. General Mathematics, Book I, pages 261 to 263. General Mathematics, Book II, pages 183 and 184.
2	Sections 114 and 115. Complete to end of No. 34, page 266.
4	Sections 116 to 118. Complete to end of No. 6, page 271.
5	Sections 120 to 122. Complete to end of exercise, page 276.
8	Sections 123 and 124. Complete to end of No. 35, page 281. General Mathematics, Book II, pages 185 to 187.
2	Summary of above types; review exercise.

Periods	Topics
	Chapter XIII (15 periods)
	The teacher should make sure that the pupils understand that cancellation means the division of a factor of the denominator into a factor of the numerator.
2	Sec. 126. Complete to end of exercise, page 286.
4	Sec. 127 to 130. Complete to end of No. 29, page 292.
2	Sec. 131. Complete to end of exercise, page 293.
3	Sec. 132. Complete to end of No. 51, page 296.
4	Review exercise, pages 297 to 299.
	Chapter XIV (16 periods)
3	Review axiom method, Sec. 53, and transposition method, Sec. 133. Complete to end of No. 33, page 303.
5	Sec. 134 and 135. Complete to end of No. 38, page 307.
7	Sec. 137; selected problems from all the exercises in the remaining part of the chapter.
1	Review or test.
	Simultaneous Equations with Two Unknowns (8 periods)
5	General Mathematics, Book II, pages 136 to 138.
3	Problems involving such equations. General Mathematics, Book II, Example 1, page 143. Page 144, No. 1, 5, 6, 7, 8, 11, 12, 13, 16. Page 146, No. 1, 6, 8, 11.
	NOTE—This plan leaves 2 extra periods which might be used for tests at times most suitable to the individual teacher.

GRADE IX MENSURATION — Total 15 periods

OBJECTIVES

1. To acquaint the pupil with methods of finding areas and volumes of simple geometrical figures, and to apply this knowledge to the solution of practical problems which occur in daily life.
2. To stimulate the desire for research on the part of the pupil to problems which occur in the home.

SUGGESTIONS

It is suggested that this course be made as practical as possible. Each pupil should be encouraged to undertake a project in his own home, such as calculating the cost of painting the house, or the cost of fencing the entire property, or the cost of reroofing the house, etc.

PERIODS	TOPICS
2	Review briefly English units of length and area. Unit of length—yard; derived units—inch, foot, mile; Unit of area—sq. yd.; derived units—sq. in., sq. ft., acre. Sec. 46, parts (1) and (2); Sec. 47. Page 113, No. 1, 2, 3; page 115, No. 1, 2, 3, 4; page 181, No. 1, 10, 11; page 356, No. 1 and 2.
2	Sec. 70. Page 181, No. 3, 5, 6, 7, 12, 13.
7	Circle: Sections 60, 61, 152, 153. Exercises, pages 149 and 150, to end of No. 19. Exercises, pages 350 to 352, to end of No. 17.
1	Sec. 155; page 357, No. 8, 9, 13, 22, 23.
1	Volume of rectangular solid (Sec. 46). Page 113, No. 7; page 115, No. 5, 6, 7, 8.
2	Sec. 156; page 357, No. 10, 11, 12, 17, 18, 25, 28, 32.

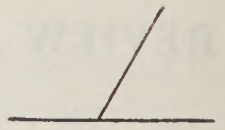
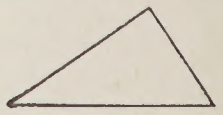
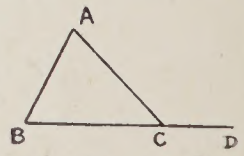
REVIEW AND EXAMINATIONS — Total 20 periods

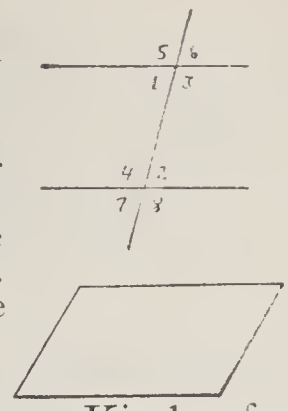
GRADE X MATHEMATICS

EXPERIMENTAL GEOMETRY AND PROP. 1 — Total 18 periods

OBJECTIVE

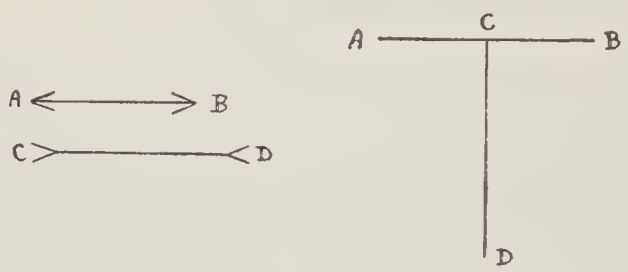
The student should be encouraged to keep a neat notebook and take pride in his constructions. The work assigned during this section should be checked by the teacher for neatness, completeness, etc. Conclusions should be noted wherever possible. The teacher should drill extensively on the mathematical language required to describe various constructions. The student should be encouraged to investigate, analyze, note conclusions, and to go to the blackboard and argue logically and clearly from a diagram.

PERIODS	TOPICS
1	Point, straight line, use of compasses to cut off a line of definite length. Triangle: definitions of vertices, sides, median, altitude.
1	Circle: definitions of centre, radius, diameter, chord, circumference, arc. Simple problems, such as: (1) Draw 3 circles with same centre and with radii 2 cm., 3.2 cm., and 4.5 cm. These circles are concentric. (2) Mark 2 points, P and Q, 3 inches apart. With P as centre and radius 1 ⅛ in. draw a circle; with Q as centre and radius 1⅞ in. draw a circle; do these circles touch each other? (3) Two forts, P and Q, are 6 miles apart. The guns in the first fort have a range of 3½ miles and those in the second have a range of 4 miles. Draw a diagram on a scale of 2 miles to 1 inch, shading the portion representing the area under fire from both forts. Measure the common chord of these circles. (4) Draw a circle whose diameter is 3.5 inches.
2	Angle: it represents the difference in direction of two lines. Its measure is the amount of rotation from the initial to the final line. Unit of measure is the degree. Kinds of angles: straight, right, acute, obtuse, reflex. Protractor: use it to measure an angle. Problems, such as: (1) Trace the set-square; measure each angle. (2) Produce each arm of the right angle of the triangle in (1) and measure the obtuse angles so formed. (3) Draw two straight lines meeting as shown. Measure each angle. Is the sum 180°? These angles are said to be supplementary.  (4) Draw any two straight lines crossing each other. Measure each angle and state whether it is acute or obtuse. Which angles measure the same or nearly the same? Give a general statement of the conclusion after consideration of several cases. (5) Draw any triangle of good size and measure each of its angles. What is their sum? What conclusion is suggested?  (6) Draw any triangle ABC. Extend BC to D. ACD is an exterior angle. Measure ∠ACD, ∠BAC, ∠ABC. Is there a relation concerning these three angles?  (7) How many degrees are there between the hands of a clock at 3 p.m.? At 4 p.m.? At 6 p.m.? (8) Draw three lines radiating from a point. Measure each of the angles. What is their sum?

Periods	Topics
1	Parallel straight lines: those which have the same direction. Name angles: alternate, corresponding, etc.; transversal. Problems, such as: (1) Draw lines along both edges of your ruler, and draw any transversal to cut these lines. (2) Measure and compare alternate angles 1 and 2; 3 and 4. (3) Name four pairs of corresponding angles. Measure each pair and write your conclusions. (5) Find a way of drawing a figure similar to the one at the right in which both pairs of opposite sides are parallel. Such a figure is called a parallelogram. Measure the opposite angles. 
2	Construct a triangle, given the lengths of the sides. Kinds of triangles: scalene, isosceles, equilateral. Problems, such as: (1) Construct a triangle with sides $2\frac{1}{2}''$, $3\frac{1}{8}''$, and $4''$. Measure the angle opposite the $4''$ side. (2) (a) Construct an isosceles triangle having each of the equal sides 82 mm., and the third side 51 mm. Measure the angles opposite the equal sides. (b) Test your conclusion by drawing another isosceles triangle. (3) Construct an equilateral triangle in which each side measures 6 cm. Measure each angle. Note the comparison and test your conclusion by constructing another equilateral triangle. (4) A, B, and C are three towns. The distance between B and C is 10 miles, between C and A is 7 miles, and between A and B is 6 miles. Draw a map of their positions using as scale 2 miles to the inch. What is your estimate of the shortest distance from A to BC?
4	Protractor construction of an angle; construction of a $\triangle$ having given 2 sides and the contained angle; construction of a $\triangle$ having given one side and 2 adjacent angles. Congruency of triangles: if one can be made to coincide with the other. Problems. such as: (1) Construct $\triangle ABC$ with $AB=6$ cm., $AC=8$ cm., $\angle BAC=70°$. (2) On tissue paper construct $\triangle DEF$ with $DE=6$ cm., $DF=8$ cm., and $\angle EDF=80°$. Will $\triangle DEF$ coincide with $\triangle ABC$? Also draw $\triangle KLM$ with $KL=6$ cm., $LM=10$ cm., and $\angle KLM=70°$. Is $\triangle KLM \equiv \triangle ABC$? Also draw $\triangle PQR$ with $QR=6$ cm., $PR=8$ cm., and $\angle PRQ=70°$. Is $\triangle PQR \equiv \triangle ABC$? (3) Draw $\triangle ABC$ with $BC=7$ cm., $\angle B=60°$, $\angle C=45°$. In which of the following cases is the $\triangle$ congruent to the $\triangle$ in question (3)? (a) $BC=7$cm., $\angle B=70°$, $\angle C=45°$. (b) $AB=6$ cm., $\angle A=60°$, $\angle B=45°$. (c) $AB=7$ cm., $\angle B=60°$, $\angle A=45°$.
1	Construct an angle equal to a given angle with ruler and compasses and describe the construction. Problems, such as: (1) Draw any $\triangle ABC$ of convenient size. (2) With ruler and compasses construct a $\triangle DEF$ having the three sides equal to the three sides of $\triangle ABC$. Is $\triangle DEF \equiv \triangle ABC$? (3) With compasses make $\triangle LMO$ with the three angles equal to the three respective angles of $\triangle ABC$. Is $\triangle LMO \equiv \triangle ABC$? (4) Draw any conclusions from the above problems.
1	Bisect a given angle with ruler and compasses and describe the construction. Problems, such as:

Periods	Topics
2	(1) Draw any angle and bisect it. Test the accuracy of your construction by measurement. (2) Draw any △ and bisect each of its angles. Examine how the three bisectors intersect each other. Repeat with another △. (3) Draw any isosceles △. Bisect the angle between the equal sides. Conclusions? (4) Bisect a given straight angle. What type of angle has been formed?

(1) Faults in the experimental method: Measurement is only an approximation; students anticipate the result; only a few cases can be considered—it is impossible to consider all cases; the senses (eyesight) are not too dependable. Various examples might be given here, such as:



Which line is longer?

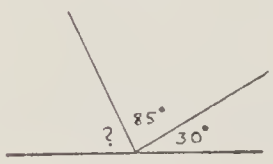
Are AB and CD straight?

(2) The need to reason carefully and clearly. Point out the errors in the following:

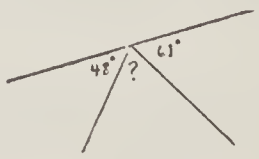
(a) Hitler convinced the German people that they could become masters of Europe without war.
(b) Mussolini reasoned that the war was over when France fell.
(c) Margaret: "I think your answer to the 5th question is wrong." Jane: "I know it is right because Helen and I both got the same answer."
(d) A man proved to his own satisfaction that changes in temperature have no effect on a steel bar. From measuring the bar with a steel rule on the hottest and coldest days of the year, he found the length of the bar always the same.
(e) A traveller reported that a coin bearing the date 70 B.C. had been unearthed at Pompeii.
(f) The insurance salesman said that my life expectancy was 20 years; therefore my life will end exactly 20 years from now.

(3) Easy examples in reasoning and in pointing out clearly at the board, such as:

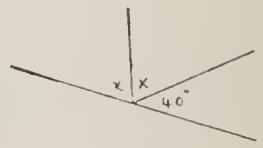
(a)



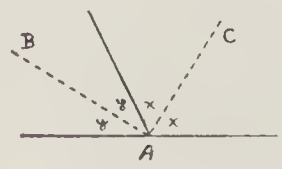
(b)



(c)

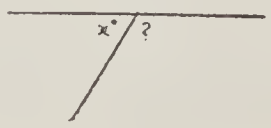


(d)

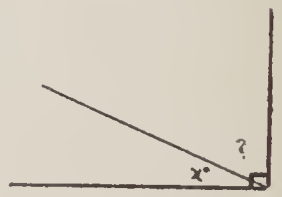


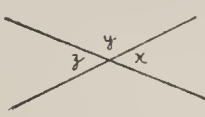
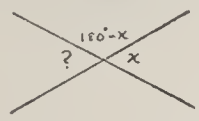
How many degrees in ∠BAC?

(e)



(f)



Periods	Topics
2	Axioms 1, 2, 3. The axioms may be taught formally, or may be treated informally as the occasion arises. Prop. 1. If two straight lines intersect, our measuring leads us to expect that the vertically opposite angles are equal. Can we show, by reasoning, that the angles *must* be equal? Use rotation method of reasoning, or any of the methods illustrated below. (i)  $z+y=180°$ $x+y=180°$ $\therefore z=x$ (ii)  $?=180°-(180°-x)$ $=180°-180°+x$ $=x$ Make up a set of diagrams which contain two lines which intersect and have the student name the equal angles. Syllogisms to illustrate reasoning: (a) If any student has 10C for home form, then he is in the Lower School. John Jackson is a student and has 10C for home room. Therefore..... (b) If a student arrives in this school after 9 a.m., he is marked late. A student, Gladys, arrived at 9.03 a.m. Therefore..... (c) If an animal is a horse, it has 4 feet. This animal is a horse. Therefore..... (d) If an animal is a horse, it has 4 feet. This animal has 4 feet. Therefore..... (e) All Torontonians live in Ontario. Mr. Bertram lives in Ontario. Therefore..... (f) John is the same height as Bill. Ken is the same height as Bill. Therefore..... (g) If things are equal to the same thing, they are equal to each other. $\angle BAC=\angle LMO$ and $\angle XYZ=\angle LMO$. Therefore..... (h) If two straight lines intersect each other, then the vertically opposite angles are equal. ADL and CDF are two straight lines intersecting at D. Therefore..... (i) Two straight lines KL and RL are produced through L to M and S respectively. Therefore..... (j) If two straight lines intersect each other, then the vertically opposite angles are equal. ABC and EFG are two straight lines. Therefore.....
1	Review or test period.

PROP. 2 TO PROP. 24 OF BOOK I — Total 66 periods

Objectives

To develop the exercise of judgment and the power to reason logically, concisely and with authority.

To acquire a knowledge of geometric figures and relationships.

Suggestions

The work should be presented in such a manner that it becomes a challenge to the student. It is suggested that the student be trained to give proofs orally at the board with the aid of a diagram. He should be encouraged to present various arguments as proofs for problems. Definitions should be emphasized as they occur. Three deductions of average difficulty are usually considered a sufficient homework assignment in Grade X. Oral drill is desirable at all times. The teacher may follow the general plan of the text, or he may leave some of the harder deductions until additional propositions have been taught, and then come back to these more difficult deductions.

Periods	Topics
6	Prop. 2, and deductions. Concentrate on the accepted form of giving a solution, whether oral or written.
3	Prop. 3, and deductions. Deductions such as 1, 3, 8, page 19, should be reworded to the "if" and "then" form in order to clearly define what is given and required. Question 2, page 19, might be used as an introduction to Prop. 4.
4	Prop. 4, and deductions.
4	Props. 5 and 6. Exercises, page 28, No. 1, 3, 6. Props. 7 and 8. Exercises, page 31, No. 1, 2, 5, 6. Prop. 7 might be taught as the bisection of a straight angle.
2	Props. 9 and 10. Exercises, page 34, No. 2, 3, 4, 5, 6.
1	Prop. 11.
3	Parallel lines: review names of angles; introduction to indirect method. Prop. 12: give a second diagram for this proposition. Deductions, page 40, No. 3, 4, 5, 6. 
1	Prop. 13, and corollary, page 42.
1	Converse statements.
4	Prop 14. Deductions, page 45, No. 1, 2, 3, 4, 5, 6, 9, 10, 12. The first time over, this proposition might be shortened by making use of the definition of an angle. The corresponding angles are equal since they are contained by the pairs of lines having the same directions. Use this fact then, to prove the alternate angles equal and the interior angles on the same side of the transversal supplementary. This suggestion is offered due to considerable confusion between Prop. 12 and Prop. 14. both of which use the indirect method in the text.
1	Prop. 15.
5	Prop. 16 and corollaries. Deductions, page 48, No. 1 (Figs. 1 to 9), 3 (a) and (b). Deductions, page 50, No. 1, 2, 3, 6, 7, 8, 11, 12.
3	Prop. 17; deductions, page 57, No. 1, 2, 5, 6, 7, 8.
4	Prop. 18, taken as a deduction in class. Deductions, page 59, questions 1 to 9.
2	Prop. 19; deductions, page 61, No. 3, 5, 6.

Periods	Topics
2	Props. 20 and 21; taken as deductions. Prop. 22; this proposition might be accepted as read. Deductions, page 66, No. 2, 6, 8.
5	Props. 23 and 24; deductions, page 71, No. 1, 2, 3, 4, 5, 6, 8, 9.
5	Construction problems, pages 72 and 73, No. 1 to 10. Pages 79 and 80, No. 1, 3, 5, 9, 11, 14.
4	Miscellaneous deductions, pages 55 and 67, *OR* constructions, page 77.
6	Review.

BOOK II **Total 21 periods**

Objectives

To introduce and extend the mathematical concept of area.

To provide sufficient drill on the uses of the Pythagorean Theorem.

Periods	Topics
3	Introduction to Book II. Props. 1 and 2; a few questions from page 91.
2	Props. 3 and 4; to be taught in one period; a few questions from page 94.
2	Prop. 5, and corollary; a few deductions from page 96.
2	Practical applications, page 99.
5	The Pythagorean Theorem; plenty of drill on the use of this proposition is necessary. Page 101, No. 1, 2, 3; page 102, No. 10, 11, 12, 13; page 103, No. 4 and 5.
2	Formal method of finding square roots of arithmetical numbers; drill and problems on finding square roots of arithmetical numbers.
4	Applications of the Pythagorean Theorem. Page 104, No. 1, 2, 5, 6, 7; page 106, No. 2 and 3; page 107, No. 12, 14, 15.
1	Review.

Periods	Topics
	Simple Algebra (14 periods)
2	Review of simplest fundamental ideas of Grade IX algebra: (a) Meanings of $2x$, x^2, $2x^2$, $(3x)^2$, xx, $a \times a \times 2$, $x \times y$, $a \times b \times c$, $x \times x \times y \times y \times y$, $aaabbcccc$, $2a \times 3b \times 4c$. (b) Addition and subtraction of like terms. (c) Indices. (d) Signs in addition, subtraction, multiplication, division. (e) Simple substitution of positive, negative, zero values. (f) Addition and subtraction of polynomials; subtraction from zero and from unity. Selected problems from page 111, or from General Mathematics, Book I.
2	Multiplications of polynomials, including the cube of a binomial. Exercises, pages 112, 113, 122.
2	Long division; examples on pages 114 and 115. Selected problems, page 115.
2	Substitution: evaluate separate parts mentally and incorporate these values into a simple written solution. Ex., if $x=2$ and $y=-1$, write $(x-y)^2$ as $(3)^2$ rather than $[2-(-1)]^2$. Selected problems, pages 115 and 116.
1	Removal of brackets. (Insertion of brackets might be left to be discussed in factoring.) Selected problems, page 117.
1	Square of Binomial and of a Trinomial. (Square root of a special trinomial is left to be done with factoring.) Oral exercise, pages 120 and 121.
1	Simplification of expressions; stress this for such expressions as $2(x+3)^2$. Problems, page 121, No. 11, 12, 13, 14.
3	Review.
	Equations and Word Problems (19 periods)
3	Review of simple equations, verification, and fractional equations. (1) Stress the verification of the simpler answers. (2) Equations with literal coefficients might be left to Grade XI. (3) Mention briefly the difference between an equation and an identity. Problems, pages 128 and 129.
5	Problems. Practise building a vocabulary and translating from the word statement of the problem to the algebraic statement,

Periods	Topics
	the equation, each term of the equation measuring the same kind of quantity. Problems, pages 133, 134, 135.
1	Simultaneous equations in 2 unknowns. Problems on page 138, or page 144, as review. (See outline for Grade IX.)
4	Simultaneous equations. Problems, pages 139 and 140.
5	Problems: selected problems from page 144 to 153. (Exercises on pages 144 and 145 may be taken orally.)
1	Review.
	Graphs (15 periods)
	The way in which a graph illustrates the dependence of one variable upon another should be emphasized.
1	Simple graphs: area distribution graph, bar graph, broken line graph; exercises on these.
1	Graphs of simple formulae, as in Sec. 81, General Mathematics, Book I; exercises on these.
2	Co-ordinate Graphs; pages 155, 156, 157. Selected problems, pages 158, 159, 160.
3	Plot the graph of an equation, pages 161 to 166. Problems, page 164, No. 1, 2, 3, 4, 5; page 165, No. 1, 2, 4, 6; page 166, No. 8, 9, 10, 11, 13, 14.
2	Graphical solution of linear equations. Problems, page 169.
2	Graphs of simple curves: parabola—introduce the use of different units on $x-$ and $y-$ axes in graph on page 172. Circle, page 173—first example plotted as on page 173, and thereafter drawn as on page 174. Selected problems, page 176.
1	Graphical solution of linear-quadratic equations; example 3, page 174; problems, page 176, No. 2, 3, 5.
1	Graphs of identical, inconsistent, consistent equations. Examples on pages 178 and 179; problem, page 179, No. 1.
2	Drill and review of graphs.

Periods	Topics
	Factoring (12 periods)
	Consolidation and extension of the topics of Grade IX should be sought. A more complete study of factoring will be possible in Grade XI. Care should be taken with the class to be sure that they understand thoroughly when an expression is in "term" form and when it is in "factor" form. In the introductory lesson, insertion of brackets for grouping should be taught. Each day there should be a short review of types taken to date and the methods of recognizing each.
2	Grouping to get a common factor; problems, page 184.
3	Trinomials, including the square root of special trinomials. Problems, pages 120, 185, 187.
3	Difference of Two Squares; problems, pages 188 and 189.
1	Incomplete Square; limited treatment stressing example 1, page 190; selected problems, page 191.
1	Sum and Difference of two Cubes; limited treatment; examples on page 192; problems, page 192, No. 1 to 15.
2	Miscellaneous exercises; the teacher should select easier questions on page 193 or make up a list of his own.
	Applications of Factoring (13 periods)
2	H.C.F. and L.C.M., pages 196 and 197. Selected problems, page 198.
1	H.C.F. and L.C.M. where only one expression is readily factored; example on page 199; problems, page 200.
3	Reduction of fractions to lowest terms; examples 1 and 2 on page 204; problems on page 205 and top of page 206.
2	Addition and subtraction of fractions; example 3, page 204; problems, bottom of page 206 and top of page 207.
3	Multiplication and division of fractions, and Combination Questions; example 4, page 205; problems, bottom of page 207.
2	Review.

INDIRECT MEASUREMENT AND MENSURATION Total 21 Periods

Periods	Topics
	Indirect Measurement (7 periods)
	It is suggested that the pupils be taken to the school campus to measure a height indirectly using a home-made transit. Definitions of sine and cosine, page 229, and construction of triangles for ratios of 45°, 60° and 30°, on pages 234, 235, should be read by the student.
2	Applications of Pythagorean Theorem, Similar Triangles, and Scale Drawings; selected problems, pages 219 and 220.
2	Tangent, pages 221 to 223; problems, page 224.
3	Use of Transit, and use of tangents to find heights and distances; discussion of the idea that all measurement is approximate, and that the needs and degrees of accuracy vary—pages 214 to 216; examples on pages 224 and 225; problems on page 227.
	Mensuration (14 periods)
1	One period in mensuration should be used to teach the writing of formal solutions for problems.
2	Area of triangle: (1) in terms of base and altitude, (2) in terms of 3 sides (application only; no proof of formula); example on page 242. Calculation of the altitude of a triangle, given the sides. Selected problems, pages 242 and 243.
2	Surface and volume of a right prism; selected problems, page 248.
2	Surface and volume of a regular pyramid; selected problems, pages 251 and 252.
2	Sector of a circle, area of curved surface of a cone, and volume of a cone; selected problems, page 256.
2	Surface and volume of a sphere; selected problems, page 259.
3	Problems correlating geometry, trigonometry and mensuration; such as: (a) finding the slant height of a square pyramid, given the base and the vertical height; (b) finding the radius of the base and the volume of a right circular cone, given the vertical height and the angle at the vertex; (c) showing that, if each side of a triangle is doubled, the area is quadrupled.
	Note—This plan leaves 5 periods of reserve time.

REVIEW AND EXAMINATIONS Total 24 Periods